the like, and is interspersed with numerous useful hints and cautions. In the 48 pages of chapter X., the author gives a concise statement of the fixation, sectioning, staining and mounting of tissues, together with brief discussions of microtomes and section knives, drawings for book illustrations, and the preparation of models. The practicability of the method for making models of blotting paper will appeal to all biological workers.

The book is remarkably free from typographical errors. Only two or three insignificant ones have been noted by the reviewer, as: the omission of the prime marks of $A'B'$, Fig. 15, page 6; *ecently* for *recently*, page 260; and *speeimen* for *specimen*, page 282.

An extended review of the book would be superfluous as its merits are already sufficiently known to the readers of SCIENCE. Its past success is adequate commentary on the author's judgment as to what is needful in a book devoted to the principles involved in making microscopic observations.

MICHAEL F. GUYER

SCIENTIFIC JOURNALS AND ARTICLES

THE April number (volume 10, number 2) of the *Transactions of the American Mathematical Society* contains the following papers:

L. E. Dickson: "General theory of modular invariants."

I. Schur: "Beiträge zur Theorie der Gruppen linearer homogener Substitutionen."

E. J. Wilczynski: "Projective differential geometry of curved surfaces (fourth memoir)."

Edward Kasner: "Natural families of trajectories: conservative fields of force."

G. W. Hartwell: "Plane fields of force whose trajectories are invariant under a projective group."

W. A. Manning: "On the order of primitive groups."

G. D. Birkhoff: "Existence and oscillation theorem for a certain boundary value problem."

Maxime Bôcher: "On the regions of convergence of power series which represent two-dimensional harmonic functions."

THE April number (volume 15, number 7) of the *Bulletin of the American Mathematical Society* contains: Report of the February meeting of the society, by F. N. Cole; "Bézout's Theory of Resultants and its Influence on Geometry" (presidential address), by H. S. White; "On the Representation of Numbers by Modular Forms," by L. E. Dickson; "Note on Lüroth's Type of Plane Quartic Curves," by H. S. White and K. G. Miller; "Cantor's History of Mathematics," by D. E. Smith; "Shorter Notices": Slaught and Lennes' High School Algebra, by E. B. Lytle; Schoenflies' Einführung in die Hauptgesetze der zeichnerischen Darstellungsmethoden, by Virgil Snyder; Laurent's Géométrie Analytique Générale, by E. B. Cowley; Petit-Bois' Tafeln unbestimmter Integrale, by E. L. Dodd; Annuaire du Bureau des Longitudes, by E. W. Brown; "Notes"; "New Publications."

THE May number of the *Bulletin* contains: Report of the February meeting of the San Francisco Section, by W. A. Manning; "The Construction of a Space Field of Extremals," by E. G. Bill; "The Second Variation of a Definite Integral," by A. L. Underhill; "A Simpler Proof of Lie's Theorem for Ordinary Differential Equations," by L. D. Ames; "Heath's Euclid," by D. E. Smith; "Shorter Notices": Czuber's Differential- und Integralrechnung, by L. W. Dowling; Fabry's Traité de Mathématiques Générales, by C. L. E. Moore; Schubert's Auslese aus meiner Unterrichts- und Vorlesungspraxis and Loria's Passato ed Presente delle Teorie Geometriche, by Edward Kasner; Müller's Führer durch die mathematische Literatur, by G. A. Miller; Voss' Ueber das Wesen der Mathematik, by Florian Cajori; "Notes"; "New Publications."

BOTANICAL NOTES

THE BOTANY OF THE FAERÖES

EIGHT years ago under the general direction of Professor Dr. Eugene Warming the first volume of a comprehensive work on the vegetation of the Faeröes Islands was published simultaneously in Copenhagen (Det Nordiske Forlag) and London (John Wheldon & Co.). It contained 340 pages of text, ten plates and

fifty illustrations in the text. There is first a short historical chapter by Warwing on the earlier botanical investigations of the islands, followed by a chapter of about thirty pages by C. H. Ostenfeld on the geography, geology, climate, etc., in which we learn that there are about twenty islands, of all sizes, from mere islets to the larger islands thirty or more kilometers long and ten to twelve in width. They lie about 7° west of the meridian of Greenwich, and in latitude 62° north of the equator, and are nearly midway between Scotland and Iceland. In general they are mountainous, the elevations reaching to between eight and nine hundred meters. The air is moist and cool, and there is much rainfall (159.3 centimeters—nearly 64 inches).

Following these general chapters are those devoted to Phanerogamae (261 species) and Pteridophyta (24 species), by C. H. Ostenfeld; Bryophyta (338 species), by C. Jensen; Freshwater Algae (323 species), by E. Borgesen; Freshwater Diatoms (248 species), by E. Ostrup; Fungi (168 species), by E. Rostrup, and Lichens (194 species), by J. S. D. Branth.

The second volume, which appeared in 1903, includes papers on marine Algae (216 species), by F. Borgesen; Marine Diatoms (182 species), by E. Ostrup; Phytoplankton from the Sea (93 species), by C. N. Ostenfeld; Phytoplankton from the Lakes (17 species), by F. Borgesen and C. H. Ostenfeld; the Hieracia of the Faeröes (21 species), by H. Dahlstedt, and concludes with a History of the Flora of the Faeröes, by Professor Warming in his peculiarly lucid and interesting style. In summing up his conclusions he says he is fully convinced "that the whole flora—at least all the more highly organized land plants—have immigrated after the glacial period, across the sea, and from the nearest countries, lying east, especially Great Britain."

The third volume, which closes the series, contains more general papers, the first by F. Borgesen being a most interesting ecological study of the marine algae, while those that follow include "additions and corrections" to previous lists of plants, popular plant names, land vegetation, gardening and tree planting, agriculture, etc. A ten-page paper by Professor Warming—"Field-notes on the Biology of Some of the Flowers of the Faeröes"—is full of suggestive observations. In an appendix of twenty-eight pages F. Borgesen and H. Jonsson present a paper on the Distributions of the Marine Algae of the Arctic Sea and of the Northernmost Part of the Atlantic for the purpose of comparing the Faeröese Algae with that of other portions of the neighboring seas.

Throughout the work the reproductions of photographs, especially of marine algae, are most excellent and some are really quite remarkable.

THE GRASSES OF CUBA

IN a recent "Contribution" from the United States National Herbarium (Vol. XII., part 6) Professor A. S. Hitchcock publishes a "Catalogue of the Grasses of Cuba" which is "based primarily upon the collections at the Estación Central Agronómica de Cuba." Here are deposited C. F. Baker's collections, and the Sauvalle Herbarium. In addition to these Professor Hitchcock has had for study many Cuban collections in the National Herbarium, the collections by Charles Wright (in the Gray Herbarium), and those in the herbarium of the New York Botanical Garden. As a result of his careful studies he is able to enumerate more than two hundred species (228), while Grisebach included 154 and Sauvalle 170.

In the catalogue, in which the only descriptions are to be found in the analytical keys, ten tribes are represented and these include sixty-six genera. The northern botanist misses the *Aveneae, Hordeae* and *Phalarideae,* which appear to have no Cuban representatives. More than three fourths of the species are found in the genera of the series Panicaceae, and considerably more than one half (135) are in the tribe Paniceae. The largest genus (*Panicum*) contains more than a fifth of all the species. Of Bambuseae there are seven species, all of the genus *Arthrostylidium.*

As evidence of the commendable conservatism of the author may be cited the fact that he has found it necessary to found but one

new genus (*Reimarochloa*), nine new species, and to change the names (new combinations) in but nineteen cases.

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SPECIAL ARTICLES

SECONDARY CHROMOSOME-COUPLINGS AND THE SEXUAL RELATIONS IN ABRAXAS

IN Professor Castle's interesting communication on sex-heredity, published in the issue of SCIENCE for March 5, a view is advanced that is akin to the "provisional formulation" that I recently offered,[1] but seems to me a decided improvement upon it. In the course of his discussion Professor Castle points out that the "XX and X" formula, which holds true for so many insects, apparently can not be applied to the conditions in *Abraxas*, as indicated by the experimental results of Doncaster and Raynor. These results only seem explicable under the view that the relation with which we have become familiar in other insects is here reversed, the female being heterozygous and the male homozygous in respect to sex (Bateson, Doncaster); and with this conclusion I concur. Definite cytological evidence has now been produced that the same is true of some other animals. The work of Baltzer, done in Boveri's laboratory[2] shows that in the sea-urchin all the sperm-nuclei are alike, while the egg-nuclei are of two classes, approximately equal in number. All of the gamete-nuclei contain 18 chromosomes. In all of the sperm-nuclei and in one class of egg 17 of these are rod-shaped in the metaphase and anaphases of cleavage, and have a terminal attachment to the spindle, while one is a long chromosome that has a subterminal attachment and therefore is hook-shaped. In the other class of egg one of the rods is replaced by a second somewhat shorter hook-shaped chromosome. The latter, therefore, forms a distinctive differential between the sexes; and cytologically considered the female is heterozygous, the male homozygous. A cytological parallel to the condition inferred from the experimental data in the case of *Abraxas* is thus demonstrated. Furthermore, if the differential chromosome in the sea-urchin is of the same general nature as the X-element of the insects, a confirmation is given of Castle's assumption that in one class of cases (*e. g.*, Hemiptera) XX means the female condition and X the male, while in another class of cases the presence of X means the female, its absence the male.

From the point of view thus given the importance of a cytological study of *Abraxas* is manifest. Thanks to the courtesy of Mr. Doncaster, I have for some time had this material under investigation; but unfortunately it presents great practical difficulties. So much may, however, be said, that while the spermatogonal divisions present a normal appearance, the spermatocyte divisions, in both the hybrid and the pure forms, show remarkably complicated and puzzling phenomena that are unlike anything hitherto described in other insects. A detailed analysis of the distribution of the chromosomes in maturation will, I fear, prove impracticable, and as far as this particular case is concerned we are for the present reduced to mere speculative guess-work. I think, however, that we should not hesitate to guess if indications for direct observation can thus be found.

Professor Castle's assumption is that the "repulsion" between the *grossulariata* factor ("G") and the female-producing factor ("X"), postulated by Bateson, "is doubtless due to the fact that the *grossulariata* character acts as the synaptic mate to the X-element." This is, perhaps, admissible; but from the standpoint of the chromosome-hypothesis it involves the following difficulty. In the heterozygous female (GLX in Castle's formula) G is assumed to couple in synapsis, not with its own homologue or allelomorph, L (as it must do in the male GL or GG), but with a different element, X. The L factor is thus left with no synaptic mate; and this result, when followed out, is found to involve still further difficulties. Even though L be regarded as merely the absence of G, this probably does not mean the absence of an entire

[1] SCIENCE, January 8, 1909.

[2] Reported by Baltzer in *Verh. d. deutsch. Zool. Ges.*, 1908, and more recently by Boveri in *Sitzungsber. d. phys.-med. Ges., Würzburg*, 1909.